

What is claimed is:

- 1        1. A method, comprising:
  - 2                 storing a first data structure containing costs associated with
  - 3                 transmitting data between routers in a network;
  - 4                 combining the first data structure with itself to determine a cost of
  - 5                 transmitting the data; and
  - 6                 transmitting the data along a route based on the calculated cost.
- 1        2. The method of claim 1, further comprising storing a second data  
2         structure defining router connections in the network.
- 1        3. The method of claim 2, wherein storing the second data structure  
2         comprises storing a matrix defining router connections.
- 1        4. The method of claim 3, wherein storing the first data structure  
2         comprises storing a matrix, wherein the costs are based on at least one of a  
3         distance, reliability, security, or expense of transmitting the data between routers  
4         in the network.
- 1        5. The method of claim 4, wherein combining the first data structure  
2         with itself calculates the cost of transmitting the data between a source router  
3         and destination router in the network for a given number of steps at minimal  
4         cost.
- 1        6. The method of claim 5, wherein the transmitting the data along the  
2         route further comprises determining the route between the source router and the  
3         destination router based on the cost and the connection matrix.

1           7. The method of claim 2, further including determining the second  
2 data structure.

1           8. The method of claim 1, wherein transmitting the data comprises  
2 transmitting an IP data packet.

1           9. The method of claim 1, further including determining the first data  
2 structure.

1           10. An apparatus, comprising:  
2                   an interface adapted to receive a data packet;  
3                   at least one storage device to store:  
4                        a first data structure defining router connections in a  
5 network; and  
6                        a second data structure that defines a cost associated with  
7 links between routers in the network; and  
8                        a controller adapted to:  
9                           combine the second data structure with itself at least once  
10 to determine a cost for transmitting the data packet; and  
11                        determine a route based on the first data structure and the  
12 calculated cost for transmitting the data packet.

1           11. The apparatus of claim 10, wherein the first data structure  
2 comprises a first matrix that defines the router connections in the network  
3 wherein the router connections comprise adjacent router connections.

1           12. The apparatus of claim 11, wherein the second data structure  
2 comprises a second matrix that defines the cost associated with each link  
3 between adjacent routers as exponents.

1       13. The apparatus of claim 12, wherein the cost of each link between a  
2 router and itself is defined as zero and the cost for each link from a router to a  
3 non-adjacent router is defined as infinity.

1       14. The apparatus of claim 13, wherein the controller is adapted to  
2 combine the second matrix using the formula  $\min_{1 \text{ to } k} (D_{ik} * D_{kj})$ , wherein k is the  
3 number of the routers and the second matrix is represented by D that has i rows  
4 and j columns.

1       15. The apparatus of claim 14, wherein the controller is adapted to  
2 increment k if a resulting element from combining the second matrix is one.

1       16. The apparatus of claim 12, wherein the costs are based on at least  
2 one of a distance, reliability, security, or expense of transmitting the data packet  
3 between the adjacent routers in the network.

1       17. The apparatus of claim 12, wherein the controller is further  
2 adapted to combine the second matrix with itself a number of times until the  
3 cost of transmitting the data packet between a source router and destination  
4 router is minimum for a given number of steps.

1       18. The apparatus of claim 10, wherein the controller is adapted to  
2 determine a direct connection between each link of the route based on the first  
3 data structure.

1       19. The apparatus of claim 10, wherein the controller is further  
2 adapted to transmit the data packet along the route.

1       20. The apparatus of claim 10, wherein the data packet is an IP data  
2 packet.

1        21. An article comprising at least one machine-readable storage media  
2 containing instructions for routing a data packet, the instructions when executed  
3 causing a controller to:

4              represent node connections in a network in a first matrix;  
5              represent costs of transmitting the data packet between each of a  
6 plurality of nodes in a second matrix; and  
7              determine a route to transmit the data packet based on the first matrix  
8 and the second matrix.

1        22. The article of claim 21, wherein the instructions when executed  
2 cause the processor to transmit the data packet over the route.

1        23. The article of claim 21, wherein the instructions when executed  
2 cause the processor to represent adjacent node connections in the first matrix.

1        24. The article of claim 21, wherein the instructions when executed  
2 cause the processor to represent the costs as exponents in the second matrix.

1        25. The article of claim 24, wherein the instructions when executed  
2 cause the processor to represent a cost between each node and itself as zero  
3 and each node to a non-adjacent node as infinity.

1        26. The article of claim 25, wherein the instructions when executed  
2 cause the processor to combine the second matrix using the formula  $\min_{1 \text{ to } k} (D_{ik}$   
3      \*  $D_{kj})$ , wherein k is the number of the routers and the second matrix is  
4 represented by D that has i rows and j columns.

1        27. The apparatus of claim 26, wherein the instructions when executed  
2 cause the processor to increment k if a resulting element from combining the  
3 second matrix is one.

1        28. The article of claim 21, wherein the instructions when executed  
2 cause the processor to represent the costs comprises the processor to represent  
3 at least one of a distance, reliability, security, or expense of transmitting the data  
4 packet between each of the plurality of nodes.

1        29. The article of claim 21, wherein the instructions when executed  
2 cause the processor to combine the second matrix with itself a number of times  
3 until the costs of transmitting the data packet between a source node and  
4 destination node are minimum for a given number of steps.

1        30. The article of claim 21, wherein the instructions when executed  
2 cause the processor to determine the route to transmit an IP data packet.

1        31. A data signal embodied in a carrier wave comprising instructions for  
2 routing data packet to at least one of a plurality of network entities, the  
3 instructions when executed causing a controller to:

4              store a connection matrix indicating adjacent nodes in a network;  
5              store a cost matrix expressing transmission costs as exponents;  
6 and

7              determine a route for transmitting the data packet based on the  
8 connection and cost matrices from a first node to a second node.

1        32. The data signal of claim 31, wherein the instructions when  
2 executed cause the processor to transmit the packet data over the route.

1           33. A communication system, comprising:

2                 a source entity adapted to transmit a data packet;

3                 a router capable of receiving the data packet, the router adapted

4                 to:

5                         define a cost matrix containing transmission costs associated

6                 with routing the data packet between a pair of routers in a network;

7                         determine a transmission cost of transmitting the packet

8                 data to a destination entity based on the cost matrix; and

9                         transmit the data packet to the destination entity using a

10                 route associated with the transmission cost.

1           34. The communications system of claim 33, wherein the data packet is

2                 an IP data packet.